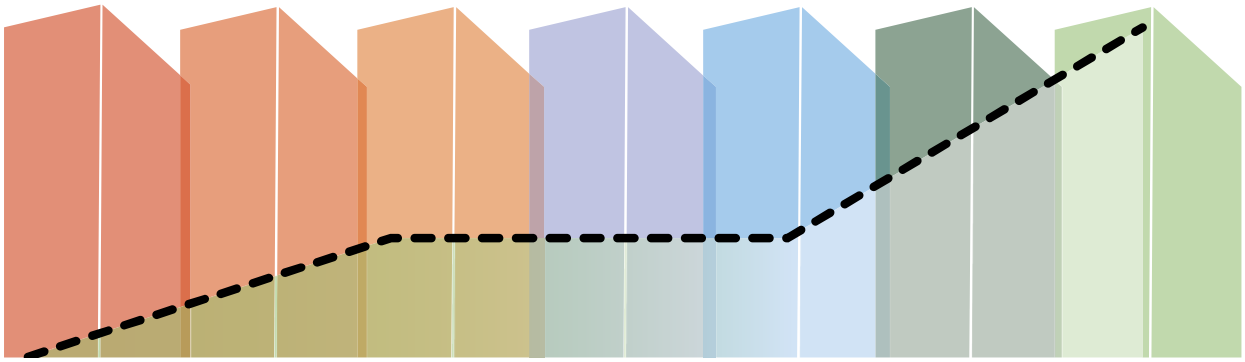

Retrofit Gateway Service

Energy Retrofit Road Map

for

[redacted] Building

Version 1.0, 9/25/2013

Chicago Metropolitan Agency for Planning

POSITIVENERGY PRACTICE

Prepared by:
PositivEnergy Practice, LLC
On behalf of:
Energy Impact Illinois

CITY OF CHICAGO – INCORPORATED 4th MARCH 1837

RETROFIT CHICAGO COMMERCIAL BUILDINGS INITIATIVE

Better Buildings CHALLENGE U.S. DEPARTMENT OF ENERGY

Guide Prepared for:

[redacted]

DISCLAIMER

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Contents

Executive Summary

This Road Map establishes an actionable path to reducing energy consumption at the [redacted] by 18% relative to 2012 consumption. The overall energy reduction is in line with the building's public commitment under the Retrofit Chicago Commercial Buildings Initiative (CBI). The potential savings identified in this Road Map represent a utility cost savings opportunity of $639,000 per year based against 2012 billings and utility rates of $[redacted] for electricity and $[redacted]/therm of gas consumed. It is estimated that a capital investment of $3,100,000 leveraging $396,000 in utility incentives will provide a 16.8%, 10-year internal rate of return, with a 5 year simple payback. The building has seen an 8.3% energy increase between 2010 and 2012 that is most likely due to an increase in occupancy over that time frame. *The Road Map will not include this energy increase for the purposes of the CBI project and representatives from the city will work with the building on this issue.*

This Road Map outlines a customized, cost effective implementation of phased energy efficiency projects that minimize first costs and maximize energy savings in the near term, as shown in the table below:

The [redacted] Building Project Summary

		Road Map Energy Conservation Measures (ECMs)			
	Previous Measures	***Phase 1***	***Phase 2***	***Phase 3***	**Project Totals**
Key Measures	Occupancy Increase (Not included in Road Map)	Lighting Retrofits and Variable Speed Drive Installations	[redacted] Variable Volume Retrofit	[redacted] Variable Volume Retrofit	**18% Energy Reduction in 5 Years**
Install Cost Before Incentives		$1,954,824	$625,700	$915,800	**$3,496,324**
Potential Utility Incentives		$278,644	$117,654	$0	**$396,299**
Capital Required		$1,676,180	$508,046	$915,800	**$3,100,025**
Annual Energy Cost Savings		$514,447	$91,067	$33,662	**$639,176**
Reduction in Annual Energy Use	-8.3%	10.5%	5.2%	2.2%	**17.9%**
Simple Payback (Years)		3.3	5.6	27.2	**4.9**
Internal Rate of Return		29.0%	13.2%	-14.3%	**16.8%**
Net Present Value (DR=5%)		$2,345,990	$214,016	-$614,227	**$1,945,778**
Implementation Timeline	2010-2012	2013-2016	2014-2015	2016-2017	**2012-2017**

In addition to achieving the building's energy reduction goal, the energy conservation measures (ECMs) outlined in this Road Map will help the building pursue additional stated goals as outlined below:

- ***Pursue Desired Certification:*** The recommendations made in all three phases of the road map are intended to reduce overall energy consumption to assist with the continued effort in pursuing an ENERGY STAR® rating. The ENERGY STAR® program is a government-backed program and is recognized by more than 85 percent of the American public; achieving this certification will allow ownership to market the building as an 'energy-efficient' building.
- ***Maintain Long Term Hold with Existing Tenants:*** Measures addressed in all three phases will continue to provide tenants with the appropriate ventilation while allowing for better control of the air quantities and temperatures delivered to each space. Improving the indoor air quality (IAQ) will improve tenant satisfaction.
- ***Maximize Performance of Existing Systems:*** The recommendations made in all phases will maximize the performance of the existing equipment increasing the overall energy efficiency of the building.
- ***Save Money Operationally:*** The recommendations made in all phases of the road map are intended to reduce maintenance and operating costs on existing building-wide operating systems and reduce overall energy consumption.

This Road Map lays out a clear implementation path that gets close to achieving the [redacted] Building's publicly stated goals within its committed timeframe in a cost efficient manner, outlines the investment benefits, and does so in line with the building's capital improvement plans. The following table details the summarized recommendations above.

Detailed Energy Conservation Measures

Chicago Metropolitan Agency for Planning POSITIVENERGY PRACTICE

ECM #		ECM Description	Total Energy Savings kBTU/yr	kBTU/sf/yr	Reduction %	Cumulative	Cost Savings $/YR1 Savings	Install Cost $	Incentives $	Capital Req. $	Payback Post Incentives years	Capital Req / Energy Savings $/kBTU saved	10YR IRR %*	Net Present Value DR=5%*
2010-2012 Completed ECMs			**-14,615,973**	**-9.6**	**-8.3%**	**-8.3%**								
Phase 1	**Prerequisite**													
1		Implement lighting retrofit measures in 24 hour burn areas	1,101,960	0.7	0.6%	0.6%	$28,292	$73,304	$12,663	$60,642	2.1	$0.06	47%	$159,054
2		Implement lighting retrofit measures in other base building areas	516,528	0.3	0.3%	0.8%	$13,261	$41,510	$5,095	$36,416	2.7	$0.07	35%	$66,944
3		Retrofit Remaining Fluorescent Exit/Stair Signs to LED	11,955	0.0	0.0%	0.9%	$307	$10,005	$1,000	$9,005	29.3	$0.75	-15%	($6,224)
4		Implement lighting retrofit measures in [redacted] Tenant Spaces	4,197,774	2.8	2.2%	3.0%	$107,774	$440,104	$5,893	$434,211	4.0	$0.10	22%	$412,368
5**		Install variable speed drives (VSDs) on cooling tower fans [redacted]	330,261	0.2	0.2%	3.2%	$8,479	$76,800	$12,000	$64,800	7.6	$0.20	6%	$3,264
6**		Install variable speed drive (VSD) on large condenser water pump [redacted]	603,873	0.4	0.3%	3.5%	$15,504	$43,200	$12,000	$31,200	2.0	$0.05	50%	$89,096
7**		Install variable speed drives (VSDs) on remaining condenser and hot water pumps [redacted]	1,063,135	0.7	0.6%	4.1%	$27,295	$221,500	$53,400	$168,100	6.2	$0.16	11%	$49,074
8a		Install variable speed drives (VSDs) on [redacted] building perimeter induction fans [redacted]	1,042,269	0.7	0.5%	4.6%	$26,759	$67,500	$16,500	$51,000	1.9	$0.05	53%	$156,493
8b		Install variable speed drives (VSDs) on [redacted] building perimeter induction fans [redacted]	487,661	0.3	0.3%	4.9%	$12,520	$81,300	$7,200	$74,100	5.9	$0.15	12%	$25,375
9		Install variable speed drives (VSDs) on interior fan systems in [redacted] building [redacted]	1,345,087	0.9	0.7%	5.6%	$34,534	$122,600	$13,500	$109,100	3.2	$0.08	30%	$160,738
10		Install variable speed drives (VSDs) on interior fan systems in [redacted] building [redacted]	4,196,653	2.8	2.2%	7.8%	$107,745	$180,700	$49,500	$131,200	1.2	$0.03	83%	$700,730
11		Retrofit remaining constant volume fan systems with variable speed drives and reduce flow by a specified reset schedule	3,537,075	2.3	1.8%	9.6%	$90,811	$487,900	$57,000	$430,900	4.7	$0.12	17%	$285,531
12		Add dewpoint economizer control to all induction unit constant volume fan systems and differential enthalpy economizer control to all interior fan systems	886,325	0.6	0.5%	10.1%	$22,756	$30,400	$18,184	$12,216	0.5	$0.01	187%	$162,748
13		Convert [redacted] floor air handling unit (AHU [redacted] chilled water coil into a self-contained cooling source	717,032	0.5	0.4%	10.5%	$18,409	$78,000	$14,711	$63,290	3.4	$0.09	27%	$80,799
		Phase 1 Totals	**20,037,588**	**13.2**	**10.5%**	**10.5%**	**$514,447**	**$1,954,824**	**$278,644**	**$1,676,180**	**3.3**	**$0.084**	**29%**	**$2,345,990**
Phase 2														
14	10	Convert constant volume regulators on the low and mid rise of the [redacted] building to variable air volume units utilizing VAV retrofit kits	10,023,683	6.6	5.2%	15.7%	$91,067	$625,700	$117,654	$508,046	5.6	$0.05	13%	$214,016
		Phase 2 Totals	**10,023,683**	**6.6**	**5.2%**	**15.7%**	**$91,067**	**$625,700**	**$117,654**	**$508,046**	**5.6**	**$0.051**	**13%**	**$214,016**
Phase 3														
15	9	Convert interior fan systems to variable air volume (VAV) in [redacted] building with the installation of VAV retrofit kits	4,255,073	2.8	2.2%	17.9%	$33,662	$915,800	$0	$915,800	27.2	$0.22	-14%	($614,227)
		Phase 3 Totals	**4,255,073**	**2.8**	**2.2%**	**17.9%**	**$33,662**	**$915,800**	**$0**	**$915,800**	**27.2**	**$0.215**	**-14%**	**($614,227)**
		Totals	**34,316,345**	**22.5**		**17.9%**	**$639,176**	**$3,496,324**	**$396,299**	**$3,100,025**	**4.9**	**$0.090**	**17%**	**$1,945,778**

* A 1% utility escalation rate was assumed for IRR and NPV calculations.

**Information provided through a previous study done for the building [redacted]

Introduction

The Gateway Services Road Map provides a strategic pathway to achieving an estimated 18% or greater reduction in energy use. It has been prepared specifically for the [redacted] Building, its building management, [redacted] and its ownership, [redacted]. This Road Map document is the result of the building ownership participating in the *Retrofit Gateway Services Program* offered by Energy Impact Illinois (EI2) in collaboration with PositivEnergy Practice (PEP), and in partnership with the City of Chicago. The Road Map sets out the business case for making energy efficiency improvements and frames investments around Internal Rate of Return (IRR) and Net Present Value (NPV).

The energy efficiency investments described in the Road Map have been grouped into distinct phases with a suggested sequence of implementation to minimize capital costs and disruption to the building's operations. In the Road Map, calculations related to the return on investment are based on energy cost and operational savings only, but a project's full return must take into account additional benefits of improved tenant relations, tenant comfort as well as reduced complaints to the building staff and potential increase in value from energy efficiency ratings or achievements.

The EnCompass tool, which was developed for EI2 by PEP, was instrumental in producing an energy model which helped further the analysis of the [redacted] Building. EnCompass is one of the many resources developed for the EI2 program by the Chicago Metropolitan Agency for Planning (CMAP), through funding provided by the U.S. Department of Energy. The tool generates a baseline model following input of basic parameters, including a building's size, construction, and systems. The EnCompass model highlights potential causes of excessive building energy consumption and suggests general approaches to energy conservation. An EnCompass account has been created for the [redacted] Building to complement the Road Map; the tool will be available on an ongoing basis as a resource for the building management team to track building updates and energy savings progress. Please see **Section 3.2** for more information about the [redacted] Building's EnCompass account.

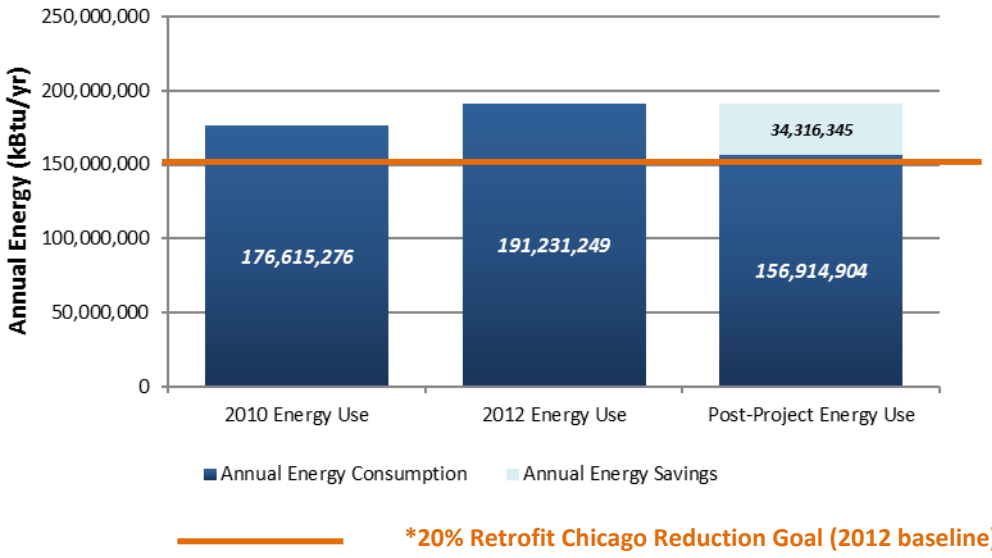
1.0 Retrofit Road Map

1.1 Retrofit Goals

In July 2013 a Q&A session was held with the [redacted] Building's management and operations staff to identify the business priorities related to energy use reduction. These priorities included: meeting its commitment of a **20% or greater reduction in five years** in line with the City of Chicago's Retrofit Chicago Commercial Buildings Initiative (CBI); pursuing desired certification; maintaining long term hold with existing tenants; maximizing performance of existing assets and saving money operationally.

Although this Road Map only addresses 18% of total energy reduction, a 20% reduction is required in the next five years to meet its energy reduction goal. The chart below summarizes estimated energy savings for the [redacted] Building. The metric of "British Thermal Unit (BTU)" is used as a common energy unit to represent both electricity and natural gas consumption by the building. This is consistent with industry practice in the U.S. and with the CBI and the ENERGY STAR® program.

Energy Baseline



1.2 Phasing of Energy Conservation Measures & Estimated Cost Savings

The Road Map is organized into three phases of implementation and subsets of recommended energy conservation measures (ECMs) per phase according to a logical order that minimizes capital costs, incorporates potential available incentives and reduces impact to the building's operations. ECM implementation is proposed to be implemented in three distinct phases based on the type of work to be implemented.

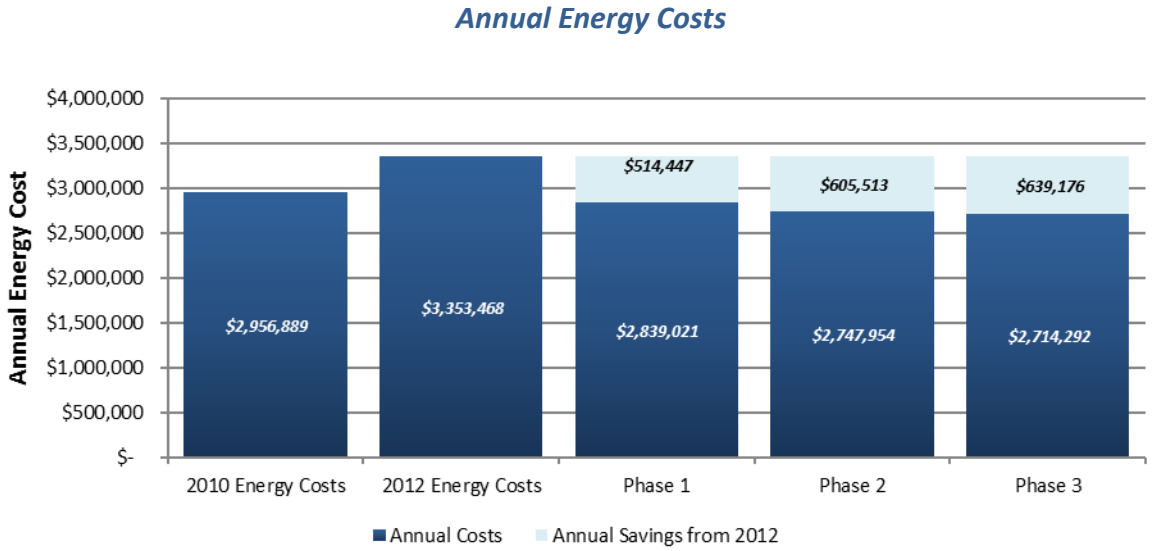
Phase 1-includes both some of the lower and higher cost measures. Base building lighting retrofits are recommended for the 24 hour burn areas, exit signs, and throughout the shared spaces. Other lighting measures include retrofitting the [redacted] tenant spaces. This phase includes several measures to install variable speed drives (VSDs) on multiple systems; the cooling tower fans, condenser water pumps, hot water pumps, induction supply fans, and interior supply fans. The installation of variable speed drives allows the same performance when needed, but reduces wasted energy when systems are not needed at high capacity. This not only saves energy but also increases the life of the motors.

Phase 2 – currently the [redacted] building uses a constant air volume fan system to provide conditioned air. This system cools the air first then reheats it to the proper occupant comfort based on the floor, which is very energy intensive. Phase 2 recommends converting to variable air volume units using variable air volume (VAV) kits which would save considerable fan, cooling and heating costs.

Phase 3 – Similar to the [redacted] building, the [redacted] building also uses a constant air volume regulator system to provide conditioned air to the building. The final phase recommends converting these to variable air volume units using VAV retrofit kits. This retrofit would save considerable fan, cooling and heating costs.

Historical and future energy cost projections are based on utility rates received from the building for December 2012 – approximately $0.0876 per kWh for electricity and $0.58 per therm for natural gas. Since the above energy savings, as well as associated cost savings, have been calculated relative to 2012 energy use and 2012 energy rates, actual future savings may differ due to escalation of energy prices.

The chart below summarizes estimated energy cost savings for the [redacted] Building following project completion.



1.3 Tenant Engagement

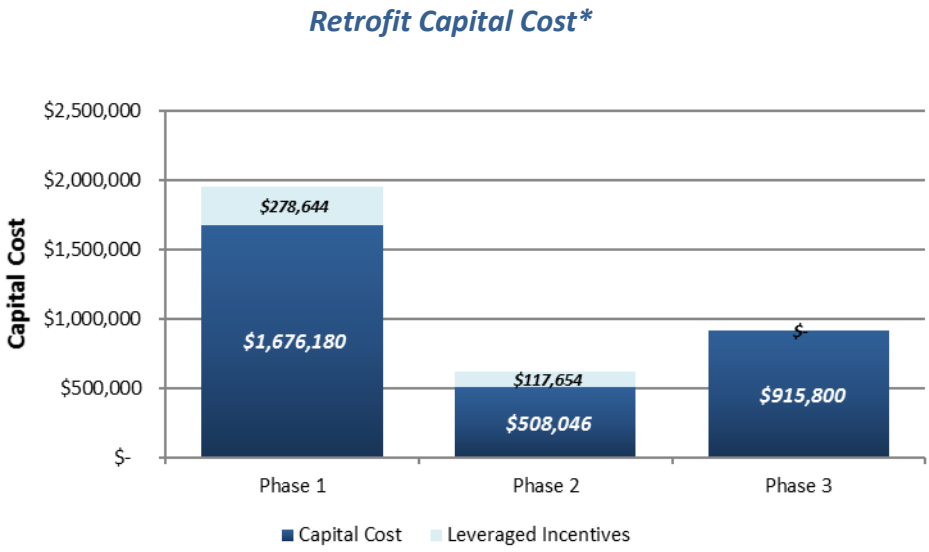
Green Office Challenge:

- The Chicago Green Office Challenge (CGOC) is another program that helps drive energy efficiency at the tenant level to create a forum for information sharing, measurement, and competition. It is our understanding that the [redacted] is already participating in this program. It is expected that the Green Office Challenge will be releasing an online building manager tool that allows building management to see their tenants' commitments and track their sustainability efforts at the building level. This may allow for improved communication between the building management and building tenants and sharing of knowledge, particularly around energy efficiency in tenant areas.

1.4 Capital Costs and Investment Case

The recommendations provided in this Road Map outline an investment strategy that requires a cumulative capital cost of $3.1 million. The internal rate of return of all measures combined – factoring in utility incentives – will result in a 16.8% IRR over a 10-year period and a simple payback of approximately 4.9 years. The combined ECMs make a strong business case.

A 10-year internal rate of return has been used to evaluate all ECMs. This IRR appropriately characterizes the period of financial return required by many property investors. Longer IRR periods could be considered as most ECMs have a longer useful life. For this Road Map, all NPV calculations use a discount rate of 5%. The figure below groups the recommended phases and the associated capital costs and leveraged incentives.



* *Implementation costs included in the document are preliminary estimates, and include materials and labor estimates. Cost estimates were derived from contractor/vendor pricing for each specific energy conservation measure.*

In addition to the capital costs outlined above, there are a number of supplemental benefits to consider in the investment strategy.

- **Energy Star Certification:** [redacted] is committed to pushing the [redacted] Building into the next echelon of sustainable buildings. The ECMs outlined in this Road Map all aim to reduce the building's energy consumption to help meet the goal of achieving ENERGY STAR certification.
- **Deliver an Outstanding Tenant Experience**: Implementation of the ECM's made in all three phases will improve the thermal comfort within the building resulting in higher tenant satisfaction.
- **Maximize Performance of Existing Assets**: The recommendations made in the first phase look to improve performance and extend the life of current systems. Installing variable speed drives eliminates wasted energy and improves the motor life.
- **Save Money Operationally:** All of the measures outlined aim to reduce energy costs for the [redacted].

1.5 Applicable Incentives

Some ECMs will qualify for utility incentives to reduce the capital cost of implementation. This Road Map outlines ECMs that may be eligible for up to an estimated $396,000 in potential utility incentives. Utility incentives included in the Road Map are based on incentives for the current program year (PY6) of ComEd's *Smart Ideas for your Business* ® and Peoples Gas programs. The prior program year ended May 31, 2013, and this program year began June 1, 2013 and extends through May 31, 2014. ComEd *Smart Ideas for your Business*® and Peoples Gas are active partners in the Gateway Services program and are available to assist in moving the recommended ECMs forward. The table below outlines the estimated potential for utility incentives available from ComEd and Peoples Gas for the [redacted] Building.

ECM #	ECM & Incentive	Incentive Amount	Electricity Savings (kWh/yr)	Gas Savings (Therms/yr)	Potential Amount
1	Implement lighting retrofit measures in 24 hour burn areas		322,966		
	Business Instant Lighting Discount ComEd Indoor and Outdoor Lighting Programs	$8/Lamp Varies			
				TOTAL	*$ 12,663*
2	Implement lighting retrofit measures in other base building areas		151,386		
	Business Instant Lighting Discount ComEd Indoor and Outdoor Lighting Programs	$8/Lamp Varies			
				TOTAL	*$ 5,095*
3	Retrofit Remaining Fluorescent Exit/Stair Signs to LED		3,504		
	ComEd Indoor Lighting Programs	$20/sign			
				TOTAL	*$ 1,000*
4	Implement lighting retrofit measures in [redacted] Spaces		1,230,297		
	Business Instant Lighting Discount ComEd Indoor and Outdoor Lighting Programs	$8/Lamp Varies			
				TOTAL	*$ 5,893*
5	Install variable speed drives (VSDs) on cooling tower fans (ComEd FA Report)		96,794		
	ComEd VSD Incentive Program	$60/HP			$ 12,000
				TOTAL	*$ 12,000*
6	Install variable speed drive (VSD) on large condenser water pump (ComEd FA Report)		176,985		
	ComEd VSD Incentive Program	$60/HP			$ 12,000
				TOTAL	*$ 12,000*
7	Install variable speed drives (VSDs) on remaining condenser and hot water pumps (ComEd FA Report)		311,587		
	ComEd VSD Incentive Program	$60/HP			$ 53,400
				TOTAL	*$ 53,400*

8a	Install variable speed drives (VSDs) on [redacted] perimeter induction fans (S-301)		305,472			
	ComEd VSD Incentive Program	$60/HP				$ 16,500
					TOTAL	*$ 16,500*
8b	Install variable speed drives (VSDs) on [redacted] perimeter induction fans (S-105, S-106, S-107)		142,925			
	ComEd VSD Incentive Program	$60/HP				$ 7,200
					TOTAL	*$ 7,200*
9	Install variable speed drives (VSDs) on interior fan systems in [redacted] (S-108, S-109, S-110)		394,223			
	ComEd VSD Incentive Program	$60/HP				$ 13,500
					TOTAL	*$ 13,500*
10	Install variable speed drives (VSDs) on interior fan systems in [redacted] (S-302, S-303, S-304)		1,229,969			
	ComEd VSD Incentive Program	$60/HP				$ 49,500
					TOTAL	*$ 49,500*
11	Retrofit remaining constant volume fan systems with variable speed drives and reduce flow by a specified reset schedule		1,036,657			
	ComEd VSD Incentive Program	$60/HP				$ 57,000
					TOTAL	*$ 57,000*
12	Add dewpoint economizer control to all induction unit constant volume fan systems and differential enthalpy economizer control to all interior fan systems		259,767			
	Comed Custon Incentive Program	$0.07/kwh saved				$ 18,184
					TOTAL	*$ 18,184*
13	Convert [redacted] air handling unit (AHU) (S-07) chilled water coil into a self-contained cooling source		210,150			
	Comed Custon Incentive Program	$0.07/kwh saved				$ 14,711
					TOTAL	*$ 14,711*
14	Convert constant volume regulators on the low and mid rise of the [redacted] building to variable air volume units utilizing VAV retrofit kits		485,435	83,674		
	Comed Custon Incentive Program	$0.07/kwh saved				$ 117,654
	Peoples Gas Custom Incentive Program	$1.00/therm saved			*TOTAL*	*$ 117,654*
15	Convert interior fan systems to variable air volume (VAV) in [redacted] building with the installation of VAV retrofit kits		132,391	38,034		
	Comed Custon Incentive Program (Exceeds 7 year payback, therefore cannot utilize)	$0.07/kwh saved			*TOTAL*	*$ -*
					TOTAL	*$ 396,299*

Electricity Utility Incentive Programs

ComEd Custom Incentive Program

https://www.comed.com/business-savings/programs-incentives/Pages/custom-projects.aspx

ComEd Custom Incentives are available for the installation of new, energy efficient equipment that is not subsidized via standard ComEd incentive programs. Typically, these incentives involve capital-intensive equipment replacement or other significant upgrades. Incentive amounts are determined based on annual electricity (kWh) savings. Each applicable measure must be applied for and approved by the ComEd Custom Incentive Program prior to installation and must be installed within a 90-day window once approved.

ComEd Interior, Outdoor, and Garage Lighting Program

https://www.comed.com/business-savings/programs-incentives/Pages/lighting.aspx

ComEd offers several incentives for specific energy efficient lighting upgrades, such as T12 to T8 lamp retrofits, time clocks, and occupancy sensors. Depending on the program, incentives will be based on the number of units installed, total watts reduced, number of lamps removed, watts controlled, or anticipated electricity savings. Incentives specific to the Gateway Services Road Map are detailed in the table above. Additional information regarding equipment specifications is available in the ComEd Lighting Incentive Application.

For most lighting projects, incentive applications must be pre-approved by the utility and must not be installed until that approval is received. Projects requiring pre-approval must be installed within a 90-day window once approved. Additionally, many incentives have prescriptive requirements for ballast type, ballast factor, lamp or fixture. These requirements are listed on the DesignLights Consortium Qualified Products list, available at http://www.designlights.org/. Ensure that documentation from any LED product manufacturer clearly defines compatibility of the LED product with the fixture being retrofitted, among other specific requirements.

ComEd Business Instant Lighting Discount

https://www.comed.com/business-savings/programs-incentives/Pages/lighting.aspx

ComEd offers its business customers a special per lamp discount on specific energy-efficient lamps such as LED, compact fluorescent, and linear fluorescent, purchased through participating electrical distributors in Northern Illinois. This discount is applied instantly to the direct cost of the lamp – there is no need for an application or rebate form. The list of lamps eligible for discount is continually being updated and can be found on ComEd's website or obtained through contacting ComEd directly.

ComEd Zero T12 Reward

ComEd now offers an additional reward, on top of other applicable lighting incentives, for eliminating all T12 lamps in a building, including any stock lamps. These rewards vary by lamp length, and there are other detailed requirements for receiving this reward, such as lamp recycling, rewards being given only once per building, and final application date of the projects. These details can be obtained through your ComEd *Smart Ideas for your Business* account manager.

ComEd Prescriptive Variable Speed Drive Incentives
https://www.comed.com/business-savings/programs-incentives/Pages/vsd.aspx

ComEd offers several incentives for specific variable speed drive upgrades to fans and pumps. Typically, these incentives involve capital-intensive equipment replacement or other significant upgrades. Incentive amounts are determined based on amount of horsepower of the pump or fan on which the variable speed drive is installed. Each applicable measure must be applied for and approved by the ComEd Variable Speed Drive Incentive Program prior to installation and must be installed within a 90-day window once approved.

For additional information regarding these and other incentives, program requirements, and application processes, contact your energy services provider. The contact information for your account manager, who has been briefed on the Road Map, is listed below.

Gas Utility Incentive Programs

People's Gas Commercial Custom Rebate Program

http://www.peoplesgasdelivery.com/business/rebates_custom.aspx

Commercial customers interested in energy-efficiency upgrades not covered by the Prescriptive Rebate Program can apply for incentives under the Commercial Custom Rebate Program.

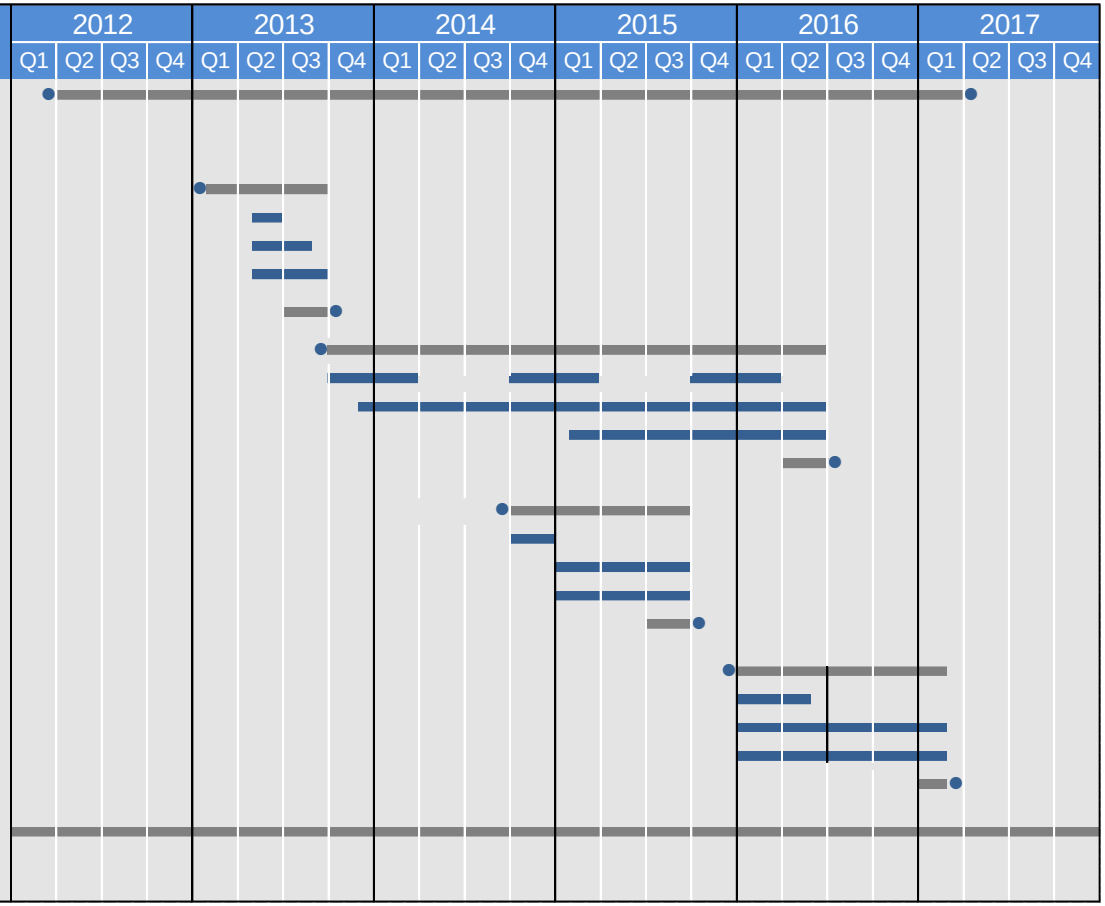
Rebates may not exceed 50% of a total project cost. Peoples Gas must approve a project application prior to the purchase and installation of equipment, which must then be installed within 90 days following approval.

For additional information regarding these and other incentives, program requirements, and application processes, contact your energy services provider. The contact information for your account manager, who has been briefed on the Road Map, is listed below.

1.6 Implementation Schedule and Next Steps

A recommendation is made to undertake the recommended ECMs in a series of phases, with key preparation, incentive application and implementation steps identified.

Activity	Duration
Retrofit Chicago Commercial Building Initiative	2012-2017
Participation	Q3 2012
20% Reduction Goal Deadline	Q2 2017
Retrofit Gateway Service	8 Weeks
Opportunity Assessment	4 Weeks
Walkthrough & Review	4 Weeks
Road Map Package	8 Weeks
Follow Up Reporting	26 Weeks
Phase 1	
Engineering / Specifications	
Retrofit Implementation	
Incentives / Financing	
Implementation Complete	Q3 2016
Phase 2	
Engineering / Specifications	
Retrofit Implementation	
Incentives / Financing	
Implementation Complete	Q4 2015
Phase 3	
Engineering / Specifications	
Retrofit Implementation	
Incentives / Financing	
Implementation Complete	Q1 2017
Building & City Goals	Ongoing
CBI 20% Reduction Goal Met	Q1 2017



Phase 1 - (Q4 2013-Q3 2016)

1. Share Gateway Services Road Map deliverable with building management, engineering and building ownership to gain support and buy-in to ECMs and implementation timeline.
2. Meet with ComEd Incentives representative to ensure that ECMs currently underway have completed necessary pre-approval paper work to ensure eligibility for funds. Please reference the Gateway Services Road Map deliverable for ease of transferal.
3. Appoint Engineering Design Consultant to provide a technical evaluation of ECM 13, including a more detailed energy analysis, implementation scope of work, and vendor unit pricing.
4. For the measures above, contact Utilities Incentives Commercial Building contacts to review and start application process for these measures. Please reference the Gateway Services Road Map deliverable for ease of transferal.

5. Implement the measures identified in the Phase.
6. Implement regular "Energy Health Check-ups" to track building EUI performance on a monthly basis to ensure that energy efficiency reductions are being realized.
7. Check in with Energy Impact Illinois and Retrofit Chicago's CBI to review Road Map implementation.

Phase 2 – (Q3 2014 – Q4 2015)

1. Appoint Engineering Design Consultant to provide a technical evaluation of ECM 14, including a more detailed energy analysis, implementation scope of work, and vendor unit pricing.
2. For the measures above, contact Utilities Incentives Commercial Building contacts to review and start application process for these measures. Please reference the Gateway Services Road Map deliverable for ease of transferal.

3. Implement the measures identified in the Phase.
4. Implement regular "Energy Health Check-ups" to track building EUI performance on a monthly basis to ensure that energy efficiency reductions are being realized.
5. Check in with Energy Impact Illinois and Retrofit Chicago's CBI to review Road Map implementation.

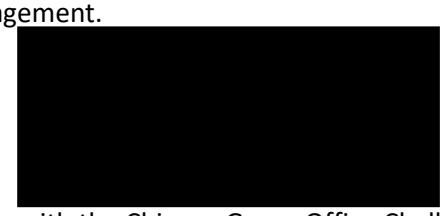
Phase 3 – (Q4 2015 – Q1 2017)

1. Appoint Engineering Design Consultant to provide a technical evaluation of ECM 15, including a more detailed energy analysis, implementation scope of work, and vendor unit pricing.
2. For the measures above, contact Utilities Incentives Commercial Building contacts to review and start application process for this measure. Please reference the Gateway Services Road Map deliverable for ease of transferal.

3. Implement the measure identified in this Phase.
4. Implement regular "Energy Health Check-ups" to track building EUI performance on a monthly basis to ensure that energy efficiency reductions are being realized.
5. Check in with Energy Impact Illinois and Retrofit Chicago's CBI to review Road Map implementation.

Tenant Engagement (Ongoing)

1. Contact Delta Institute Green Office Challenge to discuss a way to utilize the program as a cornerstone of tenant engagement.



2. Promote tenant registration with the Chicago Green Office Challenge at http://www.chicagogoc.com. Track tenant registration through the soon to be launched building manager tool set.
3. Hold quarterly tenant energy efficiency meetings to set goals, review positive achievements and collate efforts to ensure all efforts are directed towards positive savings.
4. Once tenants have registered, encourage them to complete *Activity 5.01 – Complete the Tenant Assessment* before attempting other energy-related activities.
5. Prioritize energy efficiency activities that you would like tenants to complete (you can find full descriptions at http://chicagogoc.greenpsf.com/activities).
6. Establish regular methods of communication including newsletters, email bursts, information tables in the building lobby etc.
7. Check in with Energy Impact Illinois and Retrofit Chicago's CBI to review Road Map implementation.

Energy Impact Illinois

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eplagman@cmap.illinois.gov
(312) 386-8689

Retrofit Chicago's Commercial Building Initiative

Jamie Ponce
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2.0 Building Overview

The initial step in crafting a retrofit road map plan is the acquisition of a comprehensive knowledge base of the building's past and current mechanical systems, operations, energy consumption, and tenancy trends. This information is essential to identify the most productive retrofit opportunities from a financial and implementation perspective. The following section outlines the current understanding of the [redacted] Building that forms the basis for road map formulation.

2.1 General Summary

Building Facts

Address: [redacted] Chicago, IL
Primary Use: Office and Retail
Total Floor/Conditioned Space: 771,986SF ([redacted]), 754,112 SF ([redacted])
Utility Budget: ~3,350,000$/ yr (2012)
2012 Energy Use Intensity (EUI): 126 kBTU/SF/YR
Current ENERGY STAR® Score: 59
Year of Construction: [redacted]
Building Manager: [redacted]
Building Architect: [redacted]
Historic Landmark: no

Background

[redacted]

3.0 Baseline Energy Analysis

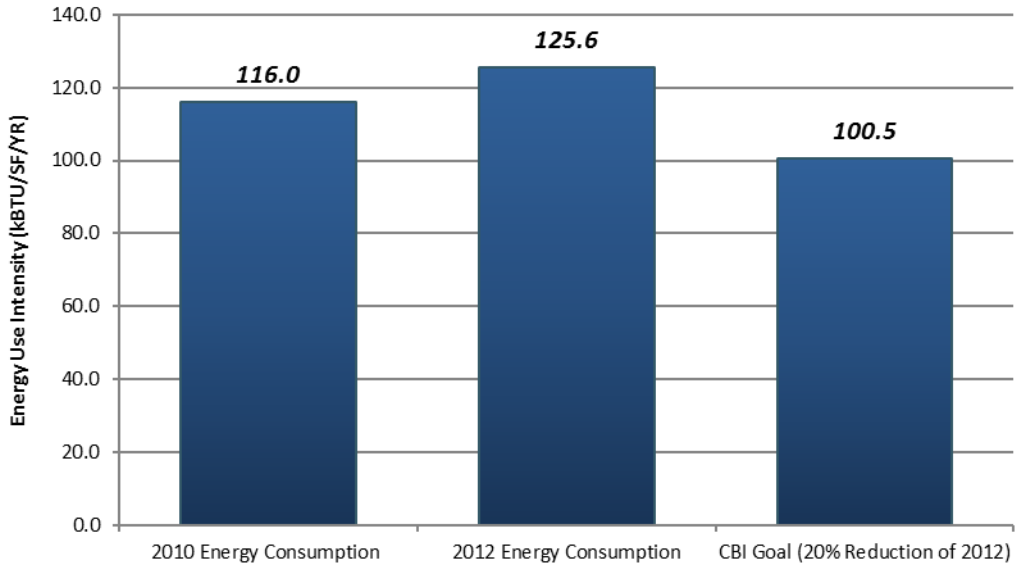
To characterize the building's current performance, an energy baseline has been used in the Gateway Services Road Map based on energy usage data provided by the building for 2012:

- **The 2012 baseline** is used to determine the building's progress toward meeting the City of Chicago's Retrofit Chicago Commercial Buildings Initiative. This baseline characterizes the building's energy performance during the most recent 12 months for which all energy usage data is available. This sets the benchmark year for which cost savings and payback periods are measured.

3.1 Current Energy Consumption and Goals

The following table illustrates the [redacted] Building's energy consumption from the baseline year 2010 to 2012. It should be noted that the building has seen an increase in consumption due to increased occupancy. This Road Map has used the baseline year of 2012, as CBI's baseline due to the increase in occupancy and energy consumption from 2010 to 2012.

The [redacted] Building Consumption

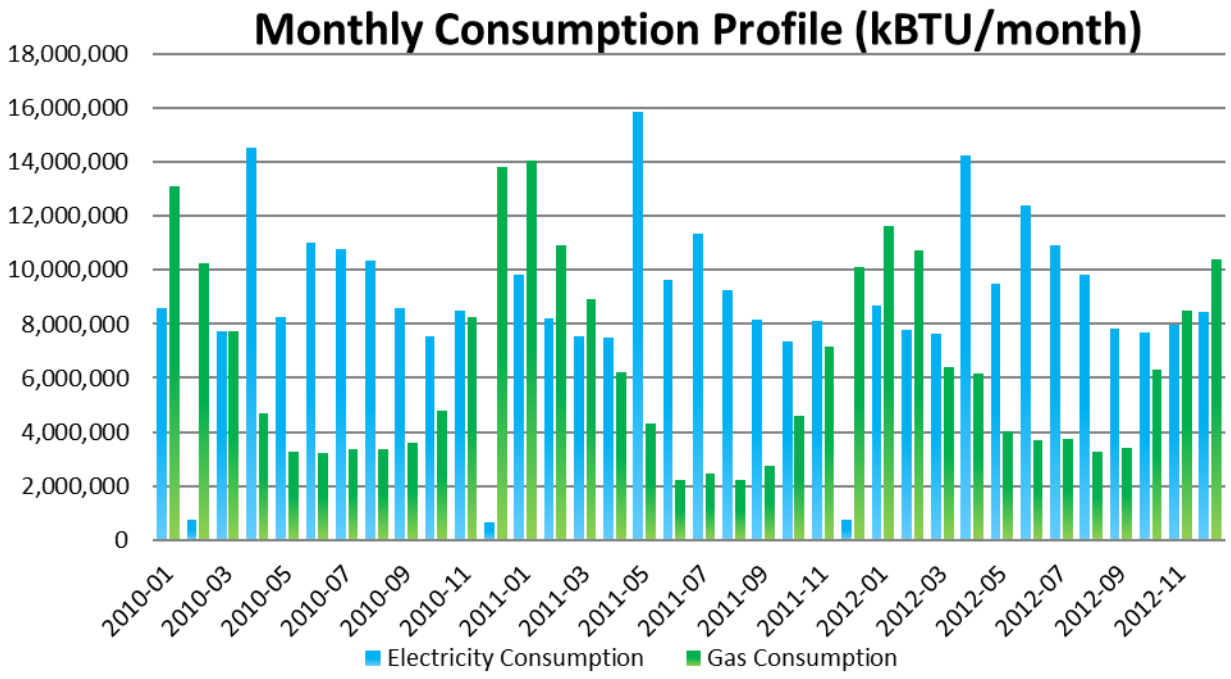


Note: *These figures are not weather adjusted for Heating Degree Days or Cooling Degree Days or normalized for any other operational changes to the building over the past 3 years.*

Historical Consumption

Energy Consumption Data	Gas Consumption (kBtu/yr)	Electrical Consumption (kBtu/yr)
2010 Annual kBtu	79,382,668	97,232,608
2011 Annual kBtu	75,993,201	103,543,075
2012 Annual kBtu	78,309,486	112,921,763

Monthly Consumption Profile



3.2 EnCompass Report and Calibration

The EnCompass Tool is one of many tools developed for the EI2 program by CMAP, under funding from the U.S. Department of Energy. Basic parameters about the building's size, construction and systems are input into the tool, and a baseline model is generated. The tool then provides a series of energy efficiency retrofit recommendations, which are detailed on the next page.

EnCompass Tool Login Information

encompass.energyimpactillinois.org

[redacted]

EnCompass Tool Baseline Inputs

[redacted]

ENERGY IMPACT ILLINOIS / ENCOMPASS

Energy Efficiency Report

[redacted] 122.7 kBTU/SF/YR

[redacted]

Get Started

Address [redacted]

Business Type

Basics

When was the building built? [redacted]

What is the gross square footage?

When was the last HVAC retrofit? [redacted]

Who is your electricity provider?

When was the last lighting retrofit? [redacted]

Electricity Rates (utility + supplier)

Heating

How do you provide heating? [redacted]

What is your boiler type?

Hot Water Variable Speed Drives?

What is your heating fuel? [redacted]

Who is your gas provider?

What is your boiler efficiency?

Gas rates (utility + supplier) [redacted]

Cooling

How do you provide cooling? [redacted]

What is your chiller efficiency?

Variable Speed Drives? No

Ventilation

What type is your ventilation system? [redacted]

Do you have AHU Air-side Economizer Cycle?

Do you have Energy Recovery Ventilation? [redacted]

Do you have CO2 based Demand Control Ventilation?

Façade

What is the window to wall ratio? [redacted]

What type of window glazing?

Window Solar Heat Gain Coefficient? [redacted]

What is the external wall U Value?

Lighting

What is the predominant lighting fixture type? [redacted]

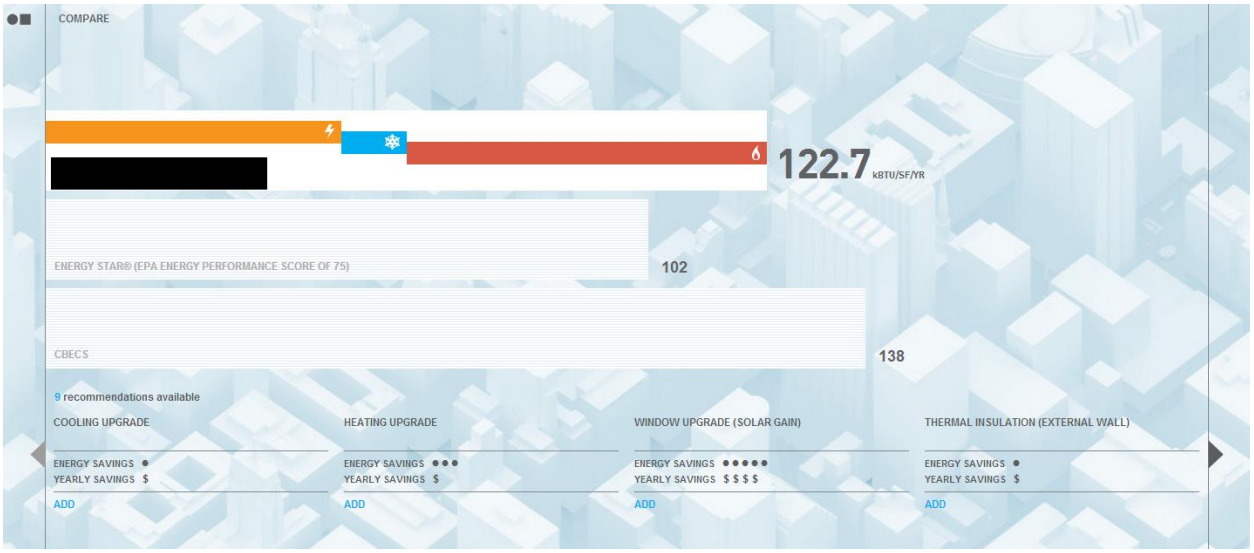
Daylight-linked dimming controls installed?

Selected Energy Retrofits

Energy Savings

Cost Savings

EnCompass Tool Compare Section



EnCompass Tool Calibration and ECM Identification

As the EnCompass tool does not currently include a link to Portfolio Manager to provide calibration of historical energy consumption for the building, this is completed here.

EnCompass vs. Utility Data

	Electricity kBtu/SF/yr	***Cooling kBtu/SF/yr***	***Heating kBtu/SF/yr***	***Total kBtu/SF/yr***
EnCompass Estimate	50.9	11.3	60.5	122.7
Utility Data	74.2		51.5	125.7
			Percent Error	***2%***

ECMs Identified by EnCompass

EnCompass ECM	***Energy Savings % Reduction***	***Annual Cost Savings Estimated by EnCompass Tool ($/yr)***	***Annual Cost Savings after Calibration ($/yr)***
Cooling Upgrade	2.6%	$116,000	$118,320
Heating Upgrade	10.7%	$98,000	$99,960
Window Upgrade	18.4%	$383,000	$390,660
Thermal Insulation (External Wall)	2.3%	$34,000	$34,680
Thermal Insulation (Windows)	6.8%	$93,000	$94,860
Variable Speed Drives (Pumps)	0.3%	$11,000	$11,220
High Efficiency Lighting	6.4%	$211,000	$215,220
CO2 Sensors	7.4%	$68,000	$69,360
Daylight Sensors	16.7%	$544,000	$554,880
TOTALS			**$1,589,160**

4.0 Conclusion

The Gateway Services Road Map has outlined and detailed energy savings opportunities for the [redacted] Building based on the 20% energy reduction goal identified by building ownership and management.

The ECMs in the Road Map provide low-risk opportunities for the building to nearly meet this goal. Investments in energy efficiency deliver reliable savings at a relatively low cost, particularly by leveraging the identified utility incentives of $396,000. In order to meet its goal, the [redacted] Building must reduce energy consumption by 2017. This Road Map outlines a specific path to nearly do so and demonstrates opportunities for a strong investment. Furthermore, the building will be able to demonstrate its goal of sustainability and energy efficiency leadership. It is important to note, although energy prices are low on a historical basis at present, they are certain to rise again making the investment case for energy efficiency even stronger. Improving building performance by reducing energy consumption is an important step to managing risk associated with volatility in the energy commodity markets.

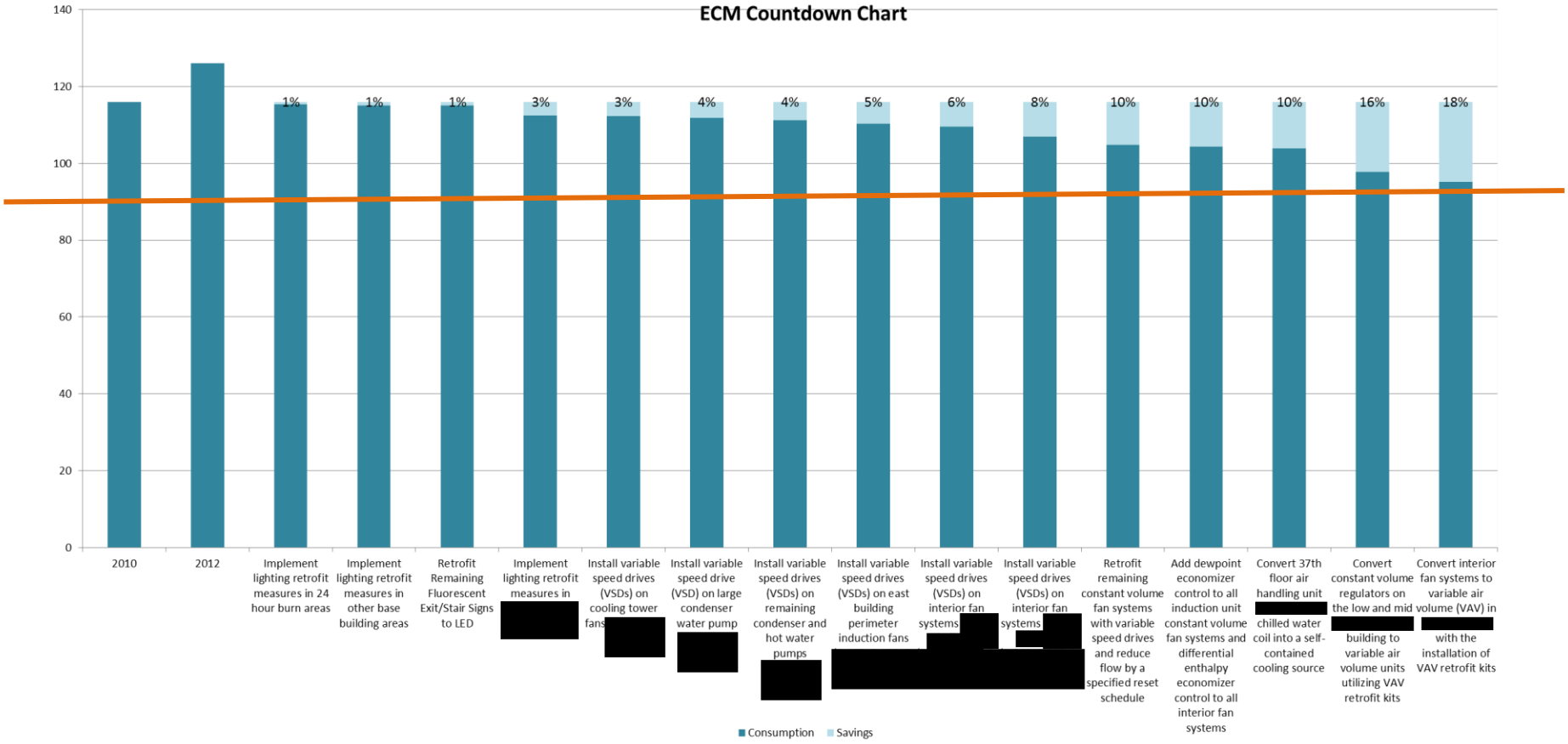
Moreover, energy efficiency and sustainability are increasingly important benchmarks by which buildings are compared to one another. Owners and managers that place an emphasis on energy efficiency improve the operations and value of their buildings and may attract partners and tenants who share similar values.

The Road Map outlines a proposed strategy for the [redacted] Building management team to achieve the stated goal of a 20% or greater reduction in energy use. The sequenced approach to investments in energy efficiency across four phases reduces demand for energy, minimizes financial risk, leverages utility incentives, and improves the reliability of building operations. By implementing the recommended energy conservation measures according to the established timeline, the [redacted] Building could satisfy and exceed its commitment to Retrofit Chicago's Commercial Buildings Initiative ahead of the 2017 deadline.

Furthermore, the [redacted] Building has the opportunity to dramatically upgrade building performance and reliability. The project presented in the Road Map, which is subject to owner and manager approval, offers a path to 18% energy reduction with a simple payback of 5 years, a 17% internal rate of return over a 10 year period, and a $1,945,778 net present value using a discount rate of 5%.

5.0 Appendices

5.1 Recommended ECM Countdown Chart



20% Retrofit Chicago Reduction Goal

5.2 Energy Conservation Measures & Descriptions

Phase 1

1. Implement lighting retrofit measures in 24 hour burn areas
Some energy savings can be had through retrofit of the base building areas which are typically burning 24 hours per day. The areas included in this measure are the following:

Stairwells - Remove 1 Lamp, Retrofit Remaining T8 to Linear LED, Install Occupancy Sensors for Non-EM Fixtures

Some energy savings can be realized through removing one 32W T8 lamp from each stairwell fixture and retrofitting the remaining 32W T8 lamps to a linear LED. Additional savings can be had by installing occupancy sensors on non-emergency fixtures in the stairwells (typically every other landing). ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

Stairwell Entry [redacted] Remove 1 Lamp

Some energy savings can be realized through removing one 25W T8 lamp from each stairwell entry fixture in each stair well at each floor in the [redacted] building. ComEd's Indoor Lighting Program incentives help reduce the implementation cost of this measure.

Loading Dock - Remove T12 Fixtures, Install LED Fixtures

Some energy savings can be realized through removal of the exterior T12 overhead fixtures in the dock area and installing new LED surface-mounted fixtures overhead. ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

Exterior - Perimeter Soffit - T12 Retrofit to Linear LED

Some energy savings can be realized through retrofit of 3' T12 lamps in exterior perimeter soffit fixtures to linear LED lamps. ComEd's Outdoor Lighting Program incentives help reduce the installation cost of this measure.

Elevators Cabs [redacted] Replace 50W MR16 Lamps with LED Lamps

Some energy savings can be realized through replacement of 50W MR16 halogen lamps in the [redacted] building elevator cabs with LED MR16 lamps. These lamps qualify for the Business Instant Lighting Discount program, which helps reduce the installation cost of this measure.

Elevator Cabs - [redacted] Replace 50W MR16 Lamps with LED Lamps

Some energy savings can be realized through replacement of 50W MR16 halogen lamps in the [redacted] building elevator cabs with LED MR16 lamps. These lamps qualify for the Business Instant Lighting Discount program, which helps reduce the installation cost of this measure.

Elevator Cabs - Freight - Retrofit T12 Lamps and Ballasts to T8 Lamps and Ballasts

Some energy savings can be realized through retrofit of freight elevator cab T12 lamps and ballasts with T8 lamps and ballasts. ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

Elevator Lobbies - Freight - [redacted] - Install Occupancy Sensors for Non-EM Fixtures

Some energy savings can be had by installing occupancy sensors on non-emergency fixtures in the elevator lobbies for the [redacted] buildings (typically 1 of 2 fixtures per landing). ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

Elevator Lobbies - Freight - [redacted] Replace T8 U-Bent Lamps with T8R U-bent Lamps and Install Occupancy Sensors for Non-EM Fixtures

Some energy savings can be realized through replacement of 32W T8 U-bent fluorescent lamps in 2x2 elevator lobby fixtures in the [redacted] building with T8 reduced wattage U-bent fluorescent lamps, as well as by installing occupancy sensors on non-emergency fixtures in the elevator lobbies for the [redacted] building (typically 1 of 2 fixtures per landing).

Elevator Lobby - [redacted] Replace 50W MR16 and 23W CFL Lamps with LED Lamps

Some energy savings can be had through replacement of 50W MR16 and 23W CFL lamps with LED lamps in the 3rd Floor [redacted] building elevator lobby. Some of these lamps qualify for the Business Instant Lighting Discount program, which helps reduce the installation cost of this measure.

2. Implement lighting retrofit measures in other base building areas

Some energy savings can be had through retrofit of the base building areas which are not typically left on 24 hours a day. The areas included in this measure are the following:

[redacted] *Lobby - T12->T8R, Incandescent->LED/CMH, T12->LED*

Significant energy savings can be realized through a number of lighting retrofits in the [redacted] lobby, including retrofit of all T12 lamps and ballasts to T8 reduced wattage lamps and ballasts, retrofit of 500W incandescent overhead lamps with ceramic metal halide fixtures, replacement of PAR halogen and other incandescent lamps with LED lamps, and retrofit of T12 lamps and ballasts to linear LED. ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure and some of these lamps qualify for the Business Instant Lighting Discount program, which also helps reduce the installation cost of this measure.

[redacted] *Corridors - Replace T8 U-Bent Lamps with T8R U-Bent Lamps*

Some energy savings can be realized through replacement of 32W T8 U-bent fluorescent lamps in 2x2 [redacted] corridor fixtures in the basement levels with T8 reduced wattage U-bent fluorescent lamps.

Mechanical Rooms [redacted] - Replace T8 Lamps with T8R Lamps

Some energy savings can be realized through replacement of 32W T8 fluorescent lamps in 2-lamp industrial fixtures in the [redacted] building mechanical rooms with T8 reduced wattage fluorescent lamps.

Fan Rooms - [redacted] - CFL->LED, T8->T8R

Some energy savings can be realized through replacement of 28W CFLs with LED lamps and 32W T8 fluorescent lamps in 2-lamp 1x4 fixtures in the [redacted] building fan rooms with T8 reduced wattage fluorescent lamps. Some of these lamps qualify for the Business Instant Lighting Discount program, which helps reduce the installation cost of this measure.

3. Retrofit remaining fluorescent exit/stair signs to LED

Some energy savings can be seen through replacement of remaining existing fluorescent exit and stair signs with LED exit and stair signs throughout the building. ComEd's Interior Lighting Program incentives bring down some of the overall capital required for installation of the exit signs.

4. Implement lighting retrofit measures in the [redacted] Building tenant spaces

Significant energy savings can be realized through retrofit of the lighting in [redacted] Tenant spaces. The spaces included in this measure are the following:

[redacted] *Retrofit PAR38 Lamps to CMH Fixtures*

Some energy savings can be realized through retrofit of 250W PAR38 halogen lamps over the [redacted] office areas on the main level to ceramic metal halide fixtures. ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

[redacted] *- CFL->LED*

Some energy savings can be realized through replacement of CFLs over [redacted] teller areas with LED lamps. These lamps qualify for the Business Instant Lighting Discount program, which also helps reduce the installation cost of this measure.

[redacted] - [redacted] *- CFL Removal, PAR38->LED*

Some energy savings can be realized through removal of existing CFL downlights along artwork wall and replacement of PAR38 halogen lamps highlighting artwork with LED fixtures. ComEd's Indoor Lighting Program incentives help reduce the installation cost of this measure.

[redacted] *- Typical Office Floors* [redacted] *Replace T8 Lamps with T8R Lamps*

Significant energy savings can be realized through replacement of 32W T8 fluorescent lamps in 2-lamp 1x4 recessed parabolic fixtures in the [redacted] building typical [redacted] office floors with T8 reduced wattage fluorescent lamps.

[redacted] *- Typical Office Floors -* [redacted] *Replace T8 Lamps with T8R Lamps*

Significant energy savings can be realized through replacement of 32W T8 fluorescent lamps in 2-lamp 1x4 recessed parabolic fixtures in the [redacted] building typical [redacted] office floors with T8 reduced wattage fluorescent lamps.

[redacted] - *Typical Office Floors* - [redacted] *Replace T8 U-Bent Lamps with T8R U-Bent Lamps*

Some energy savings can be realized through replacement of 32W T8 U-bent fluorescent lamps in 2x2 recessed parabolic light fixtures in the [redacted] building typical [redacted] office floors with T8 reduced wattage U-bent fluorescent lamps.

5. Install variable speed drive (VSD) on large condenser water pump [redacted]

There are four (4) cooling tower cells located on the roof of the [redacted] Building, all of which are equipped with fans that are operated at constant speed. The existing cooling tower cell fans have 50 horsepower single speed motors and maintain the condenser water temperature set point by cycling the fans on and off. Typically a maximum of three chillers run to meet the load of the building. Multiple towers are required for peak cooling conditions, but only one cell is operated for the majority of cooling hours. Significant energy savings can be realized by retrofitting the cooling tower fan motors with variable speed drives. The installation of variable speed drives on the cooling tower fans will require a change of the water distribution nozzles.

6. Install VSD on large condenser water pump [redacted]

The two York chillers, which are relatively new, share one 200 HP condenser water pump. Since the pump is constant volume, both condensers need to be opened and allow for maximum condenser water flow, even while one chiller is in operation. Typically only one York chiller is operated when the outdoor air temperature is below 80°F. Providing a variable speed drive (VSD) for this pump will allow for turndown of the pump speed during part load conditions. The York condenser water pump will be able to operate at 50% speed when one chiller is in operation. A fan's power varies proportionally with the cube of its speed so the pump motor will consume 1/8 of the power when the speed is reduced by half.

7. Install VSDs on remaining condenser and hot water pumps [redacted]

All condenser water pumps serving the [redacted] Building do not have variable speed drives (VSDs) and thus are operated at constant volume. All 4 of the condenser water system pumps are operated at a constant speed. There is one condenser water pump for each chiller, and the pumps operate while their respective chillers are operating. The 3-way valves in the system will be manually locked open to allow for 2-way operation, and installing a differential pressure sensor in the main loop will allow for the pumps to respond to a differential pressure set point.

8a and 8b. Install VSDs on perimeter induction supply fans (S-105, S-106,S-107 and S-301)

High velocity, high pressure supply fans provide conditioned air to the perimeter induction terminal units in the [redacted] buildings. The [redacted] Building induction supply fans operate at 7-8 inches w.c. pressure to generate 0.77 – 1.72 inches w.c. pressure at the induction unit nozzles to achieve the desired mixing of room and supply air at full load conditions. Likewise, the [redacted] Building fan operates at 11.5 inches w.c. pressure to generate 1.2 – 2.1 inches w.c. pressure at the induction unit nozzles. The pressures above can be reduced slightly during more temperate outdoor conditions between 30°F and 80°F when full air capacity is not required. Fan energy is reduced considerably with small pressure reductions. This ECM provides variable speed drives (VSDs) for the induction unit supply and return fans. The [redacted] serving the [redacted] of floors 2-10 and floors 13-22 has a supply fan (S-2) that is 25 HP and an exhaust fan (ER-2) that is 7.5 HP. The [redacted] serving the [redacted] of floors 2-10 has a supply fan (S-3) that is 30 HP and an exhaust fan (ER-3) that is 7.5 HP. The [redacted] building AHU (S-107) serving the [redacted] of floors 13-22 has a supply fan (S-4) that is 40 HP and an [redacted]

exhaust fan (ER-4) that is 10 HP. The [redacted] building AHU (S-301) serving the [redacted] has a supply fan (S-301) that is 300 HP and an exhaust fan (ER-301) that is 75 HP.

9. Install variable speed drives (VSDs) on interior fan systems in [redacted] building (S-108, S-109, S-110)

Constant air volume fan systems (S-108, S-109 and S-110) provide conditioned air to the interior spaces in the [redacted] Building. These systems provide occupant comfort by cooling all of the supply air at the central fan systems and then reheating that air as necessary on the individual floors. This process of cooling and reheat is energy intensive and requires hot water heating nearly year round. Considerable fan and hot water heating energies can be saved by converting these systems to variable air volume (VAV). This ECM involves retrofitting variable speed drives (VSDs) for the supply and return fans on these units.

10. Install variable speed drives (VSDs) on interior fan systems in [redacted] building (S-302, S-303, S-304)

Constant air volume fan systems (S-302, S-303 and S-304) provide conditioned air to the interior spaces in the [redacted] Building with reheat coils in the spaces. These systems provide occupant comfort by cooling all of the supply air at the central fan systems and then reheating that air as necessary on the individual floors. This process of cooling and reheat is energy intensive and requires hot water heating year round. Considerable fan, cooling and hot water heating energy can be saved by converting these systems to variable air volume (VAV). This ECM involves retrofitting variable speed drives (VSDs) for the supply and return fans on these units.

11. Retrofit remaining constant volume fan systems with variable speed drives and reduce flow by a specified reset schedule

The remaining constant air volume fan systems also provide conditioned air to the spaces in [redacted] buildings with reheat coils in the spaces. These systems provide occupant comfort by cooling all of the supply air at the central fan systems and then reheating that air as necessary on the individual floors. This process of cooling and reheat is energy intensive and requires hot water heating year round. Considerable fan, cooling and hot water heating energy can be saved by converting these systems to constant air volume (CV) with variable speed drives to turn down the amount of constant airflow delivered. This ECM involves retrofitting variable speed drives (VSDs) for the supply and return fans on the remaining units that didn't get retrofitted in the previous measures.

12. Add dew point economizer control to all induction unit constant volume fan systems and differential enthalpy economizer control to all interior fan systems

Currently the building economizer mode for all air handling units is initialized at 65°F dry bulb outside. Employing a more sophisticated type of control where the outside air temperature and humidity is compared to that of the return air will allow for increased energy savings during free-cooling operation. This ECM involves replacing all the air handling units return air humidity sensors with new, more reliable sensors, as well as, the programming involved at the building automation system to allow for this type of operation.

13. Convert [redacted] air handling unit (AHU) (S-07) chilled water coil into a self-contained cooling source

Currently the building has to enable the chilled water system when the 37th floor of the [redacted] building is calling for cooling. During the timeframe that the air outside is prime for air-side economizer for the rest of the air handling units within the facility, S-307 is requiring mechanical cooling. This ECM is geared towards taking the cooling coil from this air handling unit off of the central chilled water plant and installing a self-contained cooling system.

Phase 2

14. Convert constant volume regulators on the low and mid-rise of the [redacted] building to variable air volume units utilizing VAV retrofit kits

Constant air volume fan systems (S-302, S-303 and S-304) provide conditioned air to the interior spaces in the [redacted] Building with reheat coils in the spaces. These systems provide occupant comfort by cooling all of the supply air at the central fan systems and then reheating that air as necessary on the individual floors. This process of cooling and reheat is energy intensive and requires hot water heating year round. Considerable fan, cooling and hot water heating energy can be saved by converting these systems to variable air volume (VAV). This ECM involves retrofitting the constant volume regulators (CVR's) so that the air volume can be controlled on the floor. Each existing hot water reheat coil would be removed and replaced with a slide-in retrofit VAV unit with pneumatic controls and a corresponding pneumatic actuator.

Phase 3

15. Convert interior fan systems to variable air volume (VAV) in [redacted] building with the installation of VAV retrofit kits

Constant air volume fan systems (S-108, S-109 and S-110) provide conditioned air to the interior spaces in the [redacted] Building. These systems provide occupant comfort by cooling all of the supply air at the central fan systems and then reheating that air as necessary on the individual floors. This process of cooling and reheat is energy intensive and requires hot water heating nearly year round. Considerable fan and hot water heating energies can be saved by converting these systems to variable air volume (VAV). This ECM involves retrofitting variable air volume terminal units at the air shaft on tenant floors [redacted] Each existing hot water reheat coil would be removed and replaced with a slide-in retrofit VAV unit with digital controls.

5.3 Retrofit Key Considerations

The Road Map is broken out into three phases, each of which includes a series of ECMs organized in a particular sequence that maximizes opportunities. Key considerations for the implementation of each ECM are indicated below. This table may be used to prioritize measures, optimize timing, and inform decisions related to capital planning.

	ECMs								
	1	2	3	4	5	6	7	8a	8b
Key Considerations	Implement lighting retrofit measures in 24 hour burn areas	Implement lighting retrofit measures in other base building areas	Retrofit Remaining Fluorescent Exit/Stair Signs to LED	Implement lighting retrofit measures in [redacted]	Install variable speed drives (VSDs) on cooling tower fans [redacted]	Install variable speed drive (VSD) on large condenser water pump [redacted]	Install variable speed drives (VSDs) on remaining condenser and hot water pumps [redacted]	Install variable speed drives (VSDs) on [redacted] building perimeter induction fans (S-301)	Install variable speed drives (VSDs) on [redacted] building perimeter induction fans (S-105, S-106, S-107)
Phase	1	1	1	1	1	1	1	1	1
Utility incentives are available to underwrite capital cost as of 2012-13 program year.	✓	✓	✓	✓	✓	✓	✓	✓	✓
On-going Implementation.				✓					
Tenant engagement and/or lease change required for full implementation.				✓					
Ownership approval possibly required for ECMs with high capital cost.									
Investment grade analysis required before making final decision to pursue ECM.									

Key Considerations	9 Install variable speed drives (VSDs) on interior fan systems in [redacted] building (S-108, S-109, S-110)	10 Install variable speed drives (VSDs) on interior fan systems in [redacted] building (S-302, S-303, S-304)	11 Retrofit remaining constant volume fan systems with variable speed drives and reduce flow by a specified reset schedule	12 Add dewpoint economizer control to all induction unit constant volume fan systems and differential enthalpy economizer control to all interior fan systems	13 Convert [redacted] floor air handling unit (AHU) (S-07) chilled water coil into a self-contained cooling source	14 Convert constant volume regulators on the low and mid rise of the [redacted] building to variable air volume units utilizing VAV retrofit kits	15 Convert interior fan systems to variable air volume (VAV) in [redacted] building with the installation of VAV retrofit kits
Phase	1	1	1	1	1	2	3
Utility incentives are available to underwrite capital cost as of 2012-13 program year.	✓	✓	✓	✓	✓	✓	
On-going Implementation.			✓				
Tenant engagement and/or lease change required for full implementation.					✓	✓	✓
Ownership approval possibly required for ECMs with high capital cost.					✓	✓	✓
Investment grade analysis required before making final decision to pursue ECM.					✓	✓	✓